

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

| | | | | |
|--|---|--|---|--|
| 1. AGENCY USE ONLY (Leave blank) | | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED | |
| 4. TITLE AND SUBTITLE The Impact of Operation Tempo: Issues in Measurement | | | 5. FUNDING NUMBERS | |
| 6. AUTHOR(S) Castro, C. A., & Adler, A. B., | | | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Commander Attn: Medical Research Unit CMR 442 APO AE 09042 | | | 8. PERFORMING ORGANIZATION REPORT NUMBER | |
| 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U. S. Army Medical Research & Material Command Ft. Detrick, Frederick, MD 21702-5012 | | | 10. SPONSORING / MONITORING AGENCY REPORT NUMBER | |
| 11. SUPPLEMENTARY NOTES | | | | |
| 12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited. | | | 12b. DISTRIBUTION CODE | |
| 13. ABSTRACT (Maximum 200 words) Military leaders have repeatedly expressed concern about the toll operations tempo (OPTEMPO) takes on soldier and unit readiness. In a model of OPTEMPO developed by Castro and Adler (1999), peak soldier and unit performance are associated with an optimal level operational demands (e.g., OPTEMPO), and lower levels of readiness are associated with both lower and higher levels of OPTEMPO. Support for the model was found in a series of psychological screening assessments with U. S. soldiers. For example, when operations tempo was defined as the length of a deployment to Bosnia, greater rates of psychological distress were associated with longer deployments. In contrast, when operational tempo was defined as previous deployment experience, psychological distress rates were lower. Clearly, the operational definition of OPTEMPO is a critical task that is vital to understanding the impact of the pace of operations on soldiers. In an in-depth examination of the OPTEMPO model, we are conducting a two-year study of 10 units across the US Army in Europe. Measures of OPTEMPO include daily work variables such as the average number of hours worked per day and the number of hours worked per week. There are also measures that describe the tempo of a soldier's military experience, including total number of military deployments, deployment intensity (number of deployments/ number of years in the military), and training intensity (number of days on training exercises in the past six months). By addressing these diverse measures of OPTEMPO we hope to identify key variables, as well as moderating variables, that provide evidence for the OPTEMPO-Readiness Link. | | | | |
| 14. SUBJECT TERMS Unit and soldier readiness, work hours, days training, deployment time, psychological distress rates. | | | 15. NUMBER OF PAGES | |
| | | | 16. PRICE CODE | |
| 17. SECURITY CLASSIFICATION OF REPORT UNCLAS | 18. SECURITY CLASSIFICATION OF THIS PAGE UNCLAS | 19. SECURITY CLASSIFICATION OF ABSTRACT UNCLAS | 20. LIMITATION OF ABSTRACT | |

TITLE: The Impact of Operations Tempo: Issues in Measurement

AUTHORS: Carl Andrew Castro and Amy B. Adler, The U.S. Army Medical Research Unit-Europe, Nachrichten Kaserne, Karlsruher Str. 144, 69126 Heidelberg, GE.

ABSTRACT: Military leaders have repeatedly expressed concern about the toll operations tempo (OPTEMPO) takes on soldier and unit readiness. In a model of OPTEMPO developed by Castro and Adler (1999), peak soldier and unit performance are associated with an optimal level of operational demands (e.g., OPTEMPO), and lower levels of readiness are associated with both lower and higher levels of OPTEMPO. Support for the model was found in a series of psychological screening assessments with U.S. soldiers. For example, when operations tempo was defined as the length of a deployment to Bosnia, greater rates of psychological distress were associated with longer deployments. In contrast, when operational tempo was defined as previous deployment experience, psychological distress rates were lower. Clearly, the operational definition of OPTEMPO is a critical task that is vital to understanding the impact of the pace of operations on soldiers. In an in-depth examination of the OPTEMPO model, we are conducting a two-year study of 10 units across the US Army in Europe. Measures of OPTEMPO include daily work variables such as the average number of hours worked per day and the number of days worked per week. There are also measures that describe the tempo of a soldier's military experience, including total number of military deployments, deployment intensity (number of deployments/number of years in the military), and training intensity (number of days on training exercises in the past six months). By addressing these diverse measures of OPTEMPO we hope to identify key variables, as well as moderating variables, that provide evidence for the OPTEMPO-Readiness Link.

The views expressed are those of the authors and are not necessarily those of the U.S. Army or the Department of Defense.

20010411 117

The Impact of Operations Tempo: Issues in Measurement

Carl Andrew Castro and Amy B. Adler
U.S. Army Medical Research Unit-Europe

Conceptualizing, measuring, and assessing the impact of operations tempo (OPTEMPO) on soldier, family and unit readiness is a complex issue critical to understanding the impact of OPTEMPO on military readiness (Hairston, 1998; Whitlow, 1990). The conceptualization of the relationship between OPTEMPO and readiness is described in the OPTEMPO readiness model (Castro & Adler, 1999). The model predicts that the pace of military operations affects soldier and unit performance. The nature of these affects, however, may be non-linear when the pace of operations is examined at both of the extremes. When the pace of operations is either very low or very high, soldier and unit performance suffers. For instance, if soldiers or units never or seldom conduct training, then overall readiness will decline. Conversely, if soldiers or units are required to work extremely long hours, without time off for recovery, then fatigue may occur, thereby affecting performance. Additional aspects of the model such as the size of the optimal performance zone, the slope of the curve, and what influences movement along the curve are important issues to consider in understanding the OPTEMPO readiness model (see Castro & Adler, 2000).

Beyond the conceptualization of the dynamics between pace of operations and performance are the key issues associated with operationalizing the predictor (i.e. pace of operations) and outcome (i.e. performance) variables. Pace of operations, defined as "the rate of military actions of missions" (Castro & Adler, p. 87, 1999), can be measured in several different ways. Pace of operations has three components: daily workload, deployment load, and training load. Daily work load includes the number of hours worked per day, the number of days worked per week, and the number of hours worked on days that are technically "days off." Deployment load can be measured as the number of deployments that a soldier has supported. And training load includes the number of days a soldier spends training.

The readiness outcome inherent in any discussion of OPTEMPO is an equally complex but critical dimension of the OPTEMPO model. Soldier readiness, defined in this paper as "the state of being prepared mentally or physically for some experience or action," can be operationalized in a variety of ways. Readiness consists of several inter-related components that include military preparedness, physical and mental health, and familial support. Any problems in these areas may indicate a problem in or compromise military readiness.

In the present study, we examine the two parts of the prediction model – pace of operations and soldier readiness – in a systematic analysis of the variables used to define the components of the OPTEMPO readiness model. It is expected that different measures of the same constructs yield different relationships among the data.

METHODS

Research Sample

The data from this study were drawn from a large on-going longitudinal study assessing the impact of operations tempo (OPTEMPO) on U.S. Army soldiers and units stationed in Europe (Castro, Adler, and Bienvenu, 1998). The soldiers in this study completed the

questionnaire from January to March 2000. The sample consisted of 686 soldiers assigned to one of ten units (company size) stationed in either Germany or Italy. Of these units, five were combat arms units and five were combat support or combat service support.

There were 581 male soldiers (comprising 85% of the sample) and 104 female soldiers (comprising 15% of the sample), ranging in age from 18 to 49 years ($M = 25.72$, $SD = 5.61$). Junior-enlisted soldiers comprised 55% of the sample, with non-commissioned officers and commissioned officers comprising 36% and 9% of the sample, respectively. Of the commissioned officers in this sample, only two were above the rank of captain. Years of military service ranged from less than one year to 23 years ($M = 5.43$, $SD = 4.71$). Thirty-nine percent of the soldiers were high school graduates or they obtained the high school graduate equivalency degree, with 2% obtaining neither; 45% of the soldiers had some college experience, 12% earned a bachelors degree, with 1% having earned a graduate degree. Just over one-half of the soldiers were married (51%), while 40% had never been married, 3% were separated, 5% were divorced, and less than 1% were widowed. Forty-one percent of the soldiers had one or more children living with them at home and 59% of the soldiers had no children.

Operations Tempo (OPTEMPO) Measures

There were several categories of operations tempo (OPTEMPO) measures including daily workload, training load, and deployment load. Daily workload was assessed using two measures: work hours and days worked. Work hours were determined by the following question: "In the past week, how many hours of work have you averaged per day?" Days worked was determined by asking, "In the past week, how many days have you performed duty-related work?" Training load was determined by the question: "How many days have you been on a training exercise in the past 6 months?" Deployment load was determined by asking soldiers the following question: "In total, how many deployments have you completed that lasted more than 30 days?"

Unit Outcome Measures

There were 5 categories of unit outcome measures used in this analysis. Each of the measures used a 5-point response option from strongly disagree (1) to strongly agree (5).

Family Strain. Family strain due to work demands was assessed using the 5-item work-family conflict scale (Netemeyer, Boles, & McMurrian, 1996). Examples of items include: (a) "The demands of my work interfere with my home and family life." and (b) "My job produces strain that makes it difficult to fulfill family duties." The Cronbach α coefficient for the work-family conflict scale in the overall sample was 0.94.

Unit Readiness. Soldiers' perceptions of unit readiness were assessed using the 3-item operational readiness scale and the 4-item combat readiness scale (Vaitkus, 1994). The operational readiness scale consisted of the following three items: (a) "My company is ready for combat," (b) "I am confident in my unit's mission-essential equipment," and (c) "I think we are better trained than most other companies in the Army." The combat readiness scale consisted of the following four items: (a) "I think the level of training in this company is high," (b) "I have real confidence in my unit's ability to perform its mission," (c) "If we went to war tomorrow, I would feel good about going with my unit," and (d) "I think my unit would do a better in combat

than most U.S. Army units.” In this sample, the Cronbach α coefficient’s for the operational readiness scale and the combat readiness scale was 0.81 and 0.91, respectively.

Unit Cohesion. Unit cohesion was assessed using two scales. Cohesion among soldiers of similar ranks, also known as horizontal cohesion, was assessed using a revised scale consisting of 3-items developed by Posakoff and MacKensie (1994). The wording of the items was modified to make them more militarily relevant. The modified horizontal cohesion scale consisted of the following three items: (a) “The members of my unit are cooperative with each other,” (b) “The members of my unit know that they can depend on each other,” and (c) “The members of my unit stand up for each other.” The α coefficient for the horizontal cohesion scale was 0.91 in this study.

Cohesion between soldiers and leaders, also known as vertical cohesion, was assessed using 12-items, six items each pertaining to officers and non-commissioned officers (NCOs) (Bliese, Escolas, Christ, & Castro, 1998). The two vertical cohesion scales consisted of the following 6-items: (a) “The officers/NCOs in my unit establish clear work objectives,” (b) “The officers/NCOs in my unit are interested in my personal welfare,” (c) “The officers/NCOs in my unit delegate work effectively,” (d) “The officers/NCOs in my unit let soldiers know when they have done a good job,” (e) “The officers/NCOs in my unit avoid micromanaging soldiers’ work,” and (f) “The officers/NCOs in my unit are interested in what I think and how I feel about things.” The Cronbach α for the officer and NCO vertical cohesion scales in the current sample was 0.90 and 0.92, respectively. In this study we used the 12-item combined vertical cohesion scale.

Leadership Quality. Leadership quality was assessed using the 3-item general leadership quality scale (modified from Vaikus, 1994). The general leadership quality scale consisted of the following items: (a) “The leaders in this company would lead well in combat,” (b) “I am impressed by the quality of leadership in this company,” and (c) “My chain-of-command works well.” The Cronbach α coefficient in this sample for the general leadership quality scale was 0.90.

Job Satisfaction. Job satisfaction was assessed using a three-item scale similar to the Job Diagnostic Survey General Satisfaction Scale (Hackman & Oldham, 1975). The job satisfaction scale consisted of the following items: (a) “I am very satisfied with my job in the Army,” (b) “I like my job in the Army,” and (c) “I am satisfied with the kind of work I do on my job.” The Cronbach α coefficient in this sample for the job satisfaction scale was 0.91.

Moderating Variables

Two scales were also included in the analysis as moderator variables. The degree to which soldiers receive relevant information from their leaders was assessed with a 5-item information flow scale with the following items: (a) “I receive up-to-date information concerning the unit’s mission,” (b) “I receive up-to-date information on unit decisions that concerns soldiers,” (c) “I am notified of potential missions,” (d) “I can tell leaders when tasks are too demanding,” and (e) “I can tell leaders when the unit has been given too many tasks.” Work relevance was assessed using a 5-item meaningful work scale with the following items: (a) “I am satisfied with how much I work in my primary/secondary MOS,” (b) “I complete meaningful tasks,” (c) “I receive relevant training,” (d) “I get unit support for keeping current in my MOS skills,” and (e) “I participate in training exercises that prepare the unit for its mission.” Both scales were scored using 5 response options from never, seldom, sometimes, often, and always.

RESULTS

Family-Strain: Comparing OPTEMPO Measures

Table 1 presents the means and standard deviations of the OPTEMPO and outcome measures.

Table 1. Means and Standard Deviations of OPTEMPO and Outcome Measures

| Variables | M | SD |
|------------------------------|------|------|
| OPTEMPO Measures | | |
| Work Hours | 12.1 | 3.77 |
| Training Days | 30.8 | 31.9 |
| Times Deployed | 1.1 | 2.2 |
| Unit Outcome Measures | | |
| Work-Family Conflict | 3.27 | .97 |
| Combat Readiness | 3.01 | .97 |
| Operational Readiness | 2.96 | .94 |
| Cohesion (Vertical) | 3.13 | .79 |
| Cohesion (Horizontal) | 3.13 | .91 |
| Leadership Quality | 3.05 | .95 |
| Job Satisfaction | 3.10 | 1.06 |

N=670.

In order to test the relationship between the three measures of OPTEMPO and an outcome, we selected one of the outcome measures, work-family conflict. We then entered the three OPTEMPO measures into a stepwise regression followed by their interaction terms. The results are presented in Table 2.

Table 2. Regression Results from OPTEMPO Measures Predicting Work-Family Conflict

| Variables | Beta | SE | β | t | p< |
|---|-------|------|---------|-------|------|
| Constant | 3.28 | .037 | | 88.35 | .001 |
| Work Hours | .18 | .038 | .19 | 4.72 | .001 |
| Training Days | .063 | .039 | .064 | 1.61 | .11 |
| Times Deployed | .099 | .041 | .11 | 2.41 | .02 |
| Work Hours X Training Days | -.015 | .029 | -.021 | .52 | .60 |
| Work Hours X Times Deployed | -.044 | .036 | -.053 | 1.25 | .21 |
| Training Days X Times Deployed | -.069 | .043 | -.070 | 1.63 | .10 |
| Work Hours X Training Days X Times Deployed | -.085 | .038 | -.010 | .22 | .82 |

Note: Total $R^2 = .047$; $F(7, 659) = 5.64$, $p < .0001$.

Training Load and Unit Readiness

We selected one of the OPTEMPO measures, Days Training, and correlated it with the six outcome measures. Days training correlated with combat readiness ($r=.11$, $p<.01$) and operational readiness ($r=.075$, $p=.053$). Days Training did not correlate significantly with the measures of vertical cohesion, horizontal cohesion, leadership, or job satisfaction.

Moderating Variables, OPTEMPO and Outcome Measures

To explore the link between OPTEMPO and Unit Outcomes, we conducted two regression analyses to assess the extent to which other variables moderate the effects of OPTEMPO. Specifically, the number of hours worked and information flow were regressed on work-family conflict for junior-enlisted soldiers (Table 3) and the number of days training and meaningful work were regressed on combat readiness for the entire sample (Table 4).

Table 3.
Information Flow Moderating the Impact of Work Hours on Work-Family Conflict

| Variables | Beta | SE | β | t | p< |
|-------------------------------|------|------|---------|-------|------|
| Constant | 3.18 | .065 | | 49.18 | .001 |
| Work Hours | .23 | .071 | .21 | 3.25 | .001 |
| Information Flow | -.24 | .066 | -.24 | 3.60 | .001 |
| Work Hours X Information Flow | -.13 | .075 | -.11 | 1.68 | .095 |

Note: Total $R^2 = .11$; $F(3, 225) = 10.36$, $p<.0001$.

Table 4.
Meaningful Work Moderating the Impact of Days Training on Combat Readiness

| Variables | Beta | SE | β | t | p< |
|---------------------------------|-------|------|---------|-------|------|
| Constant | 2.78 | .042 | | 66.11 | .001 |
| Days Training | .11 | .052 | .090 | 2.07 | .040 |
| Meaningful Work | .49 | .043 | .51 | 11.51 | .001 |
| Days Training X Meaningful Work | -.097 | .056 | -.077 | 1.73 | .086 |

Note: Total $R^2 = .28$; $F(3, 389) = 50.95$, $p<.0001$.

DISCUSSION

The results demonstrate that it is critical to consider both the specific variables used to define OPTEMPO and the specific variables used to measure readiness. In the results presented here, for example, work hours and times deployed were both predictive of work-family conflict but training days was not. However, the interaction between days training and times deployed was. Thus, workload and deployment load measures of OPTEMPO predict increased family

strain. In addition, the interaction effect between two OPTEMPO variables suggests that when soldiers have deployment experience there is less work-family conflict when soldiers are experiencing a high number of training days than when the soldier does not have as much deployment experience.

The findings also demonstrate the importance of assessing numerous military readiness outcomes. For example, although the days training variable was not a significant single predictor of increased work-family conflict, it was a predictor of more positive combat readiness attitudes. Thus readiness, when defined broadly as containing military and family components, yields different types of relationships.

Finally, the findings highlight the need to assess moderator variables for OPTEMPO measures. Specifically, information flow and meaningful work moderated the impact of OPTEMPO measures on readiness. Importantly, the constructs of information flow and assigning meaningful tasks suggest mechanisms by which leaders at local levels can intervene in order to mediate the adverse effects of OPTEMPO.

As we continue to explore the zone of optimal performance, we will consider both self-report and objective outcome data in determining the impact of OPTEMPO on soldier and unit readiness. Clearly, there are several key categories of both pace of operations and readiness that deserve in-depth longitudinal analysis. This paper only represents one small component of the larger effort to understand the link between OPTEMPO and the zone of optimal soldier, unit and family performance.

REFERENCES

- Bliese, P. D., Escolas, S. M. Christ, R. E., & Castro, C. A. (1998). Human dimensions assessment of the Task Force XXI Advanced Warfighter Experiment. Alexandria, VA: Defense Technical Information Center (DTIC: ADA349889).
- Castro, C.A. & Adler, A.B. (1999). OPTEMPO: Effects on soldier and unit readiness. Parameters, Autumn, 86-95.
- Castro, C.A. & Adler, (2000). Working in the zone: Maintaining optimal readiness in U.S. soldiers. Proceedings of the 36th International Applied Military Psychology Symposium, Split, Croatia.
- Castro, C. A., Adler, A. B. & Bienvenu, R. V. (1998). A human dimensions assessment of the impact of OPTEMPO on the forward-deployed soldier. Walter Reed Army Institute of Research, Research Protocol #700, Washington, D.C.
- Castro, C. A. & Adler, A. B. (1999). Military deployments and soldier readiness. Proceedings of the 35th International Applied Military Psychology Symposium, Florence, Italy.
- Halverson, R. R., Bliese, P. D., Moore, R. E. & Castro, C. A. (1995). Psychological well-being and physical health symptoms of soldiers deployed for Operation Uphold Democracy: A summary of the human dimensions research in Haiti. Defense Technical Information Center Report, Documents ADA 298125, Alexandria, VA.
- Hairston, J. (1998). OPTEMPO to OPRED building an accurate measurement tool to determine readiness. Defense Technical Information Center Report, Documents ADA 345566, Alexandria, VA.
- Hackman, J. R. & Oldham, G. R. (1975). Development of the Job Diagnostic Survey. Journal of Applied Psychology, 60, 159-170.
- Netemeyer, R. G., Boles, J. S., & McMurrian, R. (1996). Development and validation of work-family conflict and family-work conflict scales. Journal of Applied Psychology, 81, 400-410.
- Vaikus, M. (1994). Unit Manning System: Human dimensions field evaluation of the COHORT company replacement model. Technical Report ADA 285942, Washington, D.C.
- Whitlow, J. L. (1990). A method for collectively measuring the operating tempo of individuals in Marine Corps units---Why and how. Defense Technical Information Center Report, Documents ADA 241099, Alexandria, VA.